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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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Robert J. Small

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MORGAN LEWIS & BOCKIUS LLP
1111 PENNSYLVANIA AVENUE NW
WASHINGTON, DC 20004

EXAMINER

DUCLAIR, STEPHANIE P.

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PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/568,077	Applicant(s) SMALL ET AL.	
	Examiner STEPHANIE DUCLAIR	Art Unit 1713	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 14 March 2010.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-20 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

1. This is the second office action on the merits.
2. Claims 1-2 are pending before the office for review.
3. In the response filed March 16, 2010
Claims 1, 3 and 4 were amended.
No new matter is present.

Claim Rejections - 35 USC § 103

4. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.
5. Claim 1 rejected under 35 U.S.C. 103(a) as being obvious over SMALL et al (U.S. Patent 7,524,346) in view of SINHA et al (U.S. Patent Publication No 2003/0119319).

The applied reference has a common inventor with the instant application. Based upon the earlier effective U.S. filing date of the reference, it constitutes prior art only under 35 U.S.C. 102(e). This rejection under 35 U.S.C. 103(a) might be overcome by: (1) a showing under 37 CFR 1.132 that any invention disclosed but not claimed in the reference was derived from the inventor of this application and is thus not an invention "by another"; (2) a showing of a date of invention for the claimed subject matter of the application which corresponds to subject matter disclosed but not claimed in the reference, prior to the effective U.S. filing date of the reference under 37 CFR

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1.131; or (3) an oath or declaration under 37 CFR 1.130 stating that the application and reference are currently owned by the same party and that the inventor named in the application is the prior inventor under 35 U.S.C. 104, together with a terminal disclaimer in accordance with 37 CFR 1.321(c). This rejection might also be overcome by showing that the reference is disqualified under 35 U.S.C. 103(c) as prior art in a rejection under 35 U.S.C. 103(a). See MPEP § 706.02(I)(1) and § 706.02(I)(2).

6. **With regards to claim 1**, SMALL discloses a method of polishing a substrate surface comprising providing a substrate surface having at least one feature thereon comprising ruthenium (*noble metal*) and at least one dielectric material (Col. 2 lines 9-14 and 26-31) providing an aqueous composition comprising about 0.0005 to about 1 moles/kilogram of periodic acid and from about 0.2% to about 6% by weight of silica abrasive wherein the aqueous composition is disposed between a polishing pad and the substrate surface and moving the polishing pad relative to the substrate surface while the removal rate of the ruthenium is at least 300 Å/min (Col. 2 lines 19-25, *discloses CMP which is a method wherein the aqueous composition is disposed between a polishing pad and the substrate surface and moving the polishing pad relative to the substrate surface, discloses a polishing rate of 300-2000 Å/min*).

7. SMALL is silent as to the average particle size. Therefore, one of ordinary skill in the art would have been motivated to look to the related art to find suitable particle size for etching a substrate surface having at least one feature thereon comprising ruthenium and at least one dielectric material.

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8. SINHA discloses a method of polishing a substrate surface comprising providing a substrate surface having at least one feature thereon comprising ruthenium and at least one dielectric material (Page 1 Paragraph [003]), providing an aqueous composition comprising about 0.2 to about 6% by weight (Page 4 Paragraph [0034]) silica abrasives having an average particle size of about (50 nm or less). SINHA discloses a range of particle sizes that overlaps with applicant's range and in the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art" a prima facie case of obviousness exists. In re Wertheim, 541 F.2d 257, 191USPQ 90 (CCPA 1976); In re Woodruff, 919 F.2d 1575, 16 USPQ2d 1934 (Fed.Cir. 1990). One of ordinary skill in the art at the time of the invention would have had a reasonable expectation of predictably achieving the desired aqueous composition using the particle size of SINHA.

9. Claims 1, 5, 7, 14 and 18-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over BRUSI et al (U.S. Patent No. 6,527,622) in view of SINHA et al (U.S. Patent Publication No 2003/0119319).

10. **With regards to claim 1**, BRUSI discloses a method of polishing a substrate surface comprising a substrate surface having at least one feature thereon comprising ruthenium (Col. 1 lines 52-57, Col. 2 lines 66-67) from about 0.0005 to about 1 moles/kilogram of periodic acid (Col. 6 lines 31-40; Col. 6 line 12) and from about 0.2% to about 6% by weight of silica abrasive (Col. 13 lines 31, 46-48) wherein the aqueous composition is disposed between a polishing pad and the substrate surface (Col. 3 lines

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14-18). While BRUSI does not disclose applicant's exact concentrations, generally, differences in concentration or temperature will not support the patentability of subject matter encompassed by the prior art unless there is evidence indicating such concentration or temperature is critical. "[W]here the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation." *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955). Therefore one of ordinary skill in the art would pick the appropriate concentrations of the disclosed components in order to optimize the appropriate etching conditions.

11. BRUSI is silent as to the average particle size. Therefore, one of ordinary skill in the art would have been motivated to look to the related art to find suitable particle size for etching a substrate surface having at least one feature thereon comprising ruthenium and at least one dielectric material.

12. SINHA discloses a method of polishing a substrate surface comprising providing a substrate surface having at least one feature thereon comprising ruthenium and at least one dielectric material (Page 1 Paragraph [003]), providing an aqueous composition comprising about 0.2 to about 6% by weight (Page 4 Paragraph [0034]) silica abrasives having an average particle size of about (50 nm or less). SINHA discloses a range of particle sizes that overlaps with applicant's range and in the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art" a prima facie case of obviousness exists. *In re Wertheim*, 541 F.2d 257, 191USPQ 90 (CCPA 1976); *In re Woodruff*, 919 F.2d 1575, 16 USPQ2d 1934 (Fed.Cir. 1990). One of

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ordinary skill in the art at the time of the invention would have had a reasonable expectation of predictably achieving the desired aqueous composition using the particle size of SINHA.

13. While there is not a specific embodiment with the specific composition, when the species is clearly named, the species claim is anticipated no matter how many other species are additionally named. Ex parte A, 17 USPQ2d 1716 (Bd. Pat. App. & Inter. 1990). So although "reference" has not explicitly taught the claimed composition in a singular embodiment, it would have been obvious to one of ordinary skill in the art at the time of invention to have done so since a reasonable expectation of success exists from choosing the specific taught species from the explicitly taught lists. Therefore the combined teachings of BRUSI and SINHA disclose all the limitations of the method of polishing so while the removal rate is not explicitly discloses, it is inherent the use of such composition would provide the disclosed etching rate as this is a feature of the composition as used with the surface of the substrate.

14. **With regards to claim 5**, SINHA discloses wherein the substrate comprises a ruthenium feature and at least one PETEOS dielectric, TEOS dielectric or BSPG dielectric, and wherein the removal selectivity of the ruthenium to the dielectric is greater than about 0:1 (Page 4 Paragraph [0033]).

15. **With regards to claim 7**, BRUSIC discloses wherein the silica abrasive is present in an amount between 0.2 % to about 4% by weight (Col. 3 lines 40-43) and the periodic acid is present in an amount from about 0.01 to about 0.05 moles/ kilogram of aqueous composition (Col. 6 lines 31-40). While BRUSIC does not disclose applicants

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exact range, generally, differences in concentration or temperature will not support the patentability of subject matter encompassed by the prior art unless there is evidence indicating such concentration or temperature is critical. “[W]here the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation.” In re Aller, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955).

16. **With regards to claim 14**, SINHA discloses wherein the substrate further comprises a hard mask material, Page 6 paragraph [0059], *discloses the pattern dielectric layer can be formed of any material that provides electrical isolation including silicon dioxide and silicon nitride*). SINHA discloses that the selectivity is 10:1 however it would have been obvious to one of ordinary skill in the art at the time of the invention to adjust the chemistry and process conditions in order to adjust the etching selectivity (Page 4, Paragraph [0033], *discloses that selectivity is dependant on the chemistry and process conditions*).

17. **With regards to claim 18**, BRUSI discloses wherein the polishing process is a one- step polishing process and the combined references inherent disclose wherein the polishing rate of the ruthenium is greater than 500 angstroms per minute. Col. 10 Table 3 discloses a variety of ruthenium polishing rates based on a number of combinations of known polishing additives. The combined teachings of BRUSI and SINHA disclose all the limitations of the method of polishing. So while the removal rate is not explicitly disclosed, it is inherent the use of such composition (based on the disclosure of the

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additives) would provide the claimed etching rate as this is a feature of the composition as used with the surface of the substrate.

18. **With regards to claim 19**, BRUSIC discloses wherein the composition is free of sources of chloride ions (Col. 2 lines 35-48, *discloses generally the composition of the polishing solution, does not disclose a source of chlorine, therefore the composition is free of a source of chloride ions, Col. 5 lines 14-30 discloses that a source of chloride ions may be used but this is an optional additive and not necessary for the polishing composition*).

19. **With regards to claim 20**, BURSI discloses wherein the composition comprises from about 0.3 to about 0.7 % by weight periodic acid (Col. 5, lines 66-67, *discloses the inclusion of a per-type oxidizer, Col. 6 line 12, discloses periodic acid as a per-type oxidizer, Col. 6 lines 31-40, discloses concentrations of about 0.5 to about 20 wt5 or about 0.1 to about 20 wt%*). In the case where the claimed ranges “overlap or lie inside ranges disclosed by the prior art” a prima facie case of obviousness exists. In re Wertheim, 541 F.2d 257, 191 USPQ 90 (CCPA 1976); In re Woodruff, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir. 1990).

20. Claims 2 and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over DIRKSEN et al (U.S. Patent Publication No. 2002/0076932) in view of SINHA (U.S. Patent Publication 2003/0119319).

21. **With regards to claim 2**, DIRKSEN discloses a method of polishing a substrate surface comprising providing a substrate surface having at least one feature thereon

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comprising ruthenium and at least one layer comprising a low k dielectric material (Page 1 Paragraph [0008]), contacting the substrate with a silica abrasive (Page 1 Paragraph [0009]) and with an aqueous composition comprising periodic acid and a quaternary amine (Page 2 Paragraph [0020]) wherein the solution has a pH of about 2.5 to about 5.

22. The reference of DIRKSEN is silent as to the selectivity of the ruthenium to the low k dielectric material. Therefore one of ordinary skill in the art would look to the related art to see the selectivity.

23. SINHA discloses a method of polishing a substrate surface comprising providing a substrate surface having at least one feature thereon comprising ruthenium and at least one dielectric material (Page 1 Paragraph [003]), providing an aqueous composition comprising about 0.2 to about 6% by weight (Page 4 Paragraph [0034]) silica abrasives and wherein chemically mechanically polishing the substrate surface removes a portion of the ruthenium, wherein the removal selectivity of the ruthenium to the low k dielectric is greater than 20:1. One of ordinary skill in the art at the time of the invention would have had a reasonable expectation of predictably achieving the desired etching selectivity based on the disclosure of DIRKSEN in light of the teachings of SINHA.

24. **With regards to claim 16**, DIRKSEN discloses wherein the pH of the aqueous composition is between about 3 and about 4 (Page 2 Paragraph [0018], *discloses a pH of about 5 or less*).

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25. Claims 3, 6, and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over DIRKSEN et al (U.S. Patent Publication No. 2002/0076932) in view of MOEGGENBORG et al (U.S. Patent Publication No. 2003/0060135), WANG et al (U.S. Patent No. 6,316,365) and SINHA (U.S. Patent Publication 2003/0119319).

26. **With regards to claim 3**, DIRKSEN discloses a method of polishing a substrate surface comprising providing a substrate with at least one feature thereon comprising ruthenium, a low dielectric film and a high dielectric constant film (tantalum oxide) (Page 1 Paragraph [0008]), providing an aqueous composition comprising a periodic acid (Page 2 Paragraph [0020]), silica abrasives (Page 1 Paragraph [0009]), and contacting the surface with a polishing pad in which the composition is disposed between the polishing pad and the substrate surface (Page 1 Paragraph [0003]) and sources of chloride ions (Page 2 Paragraph [0020]).

27. However, DIRKSEN is silent as to a layer of tantalum oxide, the percentage of silica abrasive and particle size, the percentage of periodic acid, 0.2-6 wt% of silica abrasives with an average particle size of 50nm or less, 0.5% or less of sources of chloride and a polishing rate of tantalum oxide between 0.8 -1.7 times ruthenium (removal rate ratio of ruthenium : tantalum oxide is 0.58-1.25 calculated based on polishing rate of 300 Å/min, disclosed on page 25 of Specification). Therefore one of ordinary skill in the art at the time of the invention would have been motivated to look to the related art for suitable

28. MOEGGENBORG discloses a chemical mechanical polishing system (Page 1 Paragraph [0010]) using a composition with silica abrasives (Page 1 Paragraph [0011])

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with a concentration between 0.1 wt% - 10 wt% (Page 2 Paragraph [0012]), suitable oxidizers including periodic acid (Page 2 Paragraph [0016]) in amounts between 0.001 wt%- 5 wt% (Page 2 Paragraph [0017]) and a substrate with a metal layer in which that layer is ruthenium (Page 3 Paragraph [0023]).

29. SINHA discloses a method of polishing a substrate surface comprising providing a substrate surface having at least one feature thereon comprising ruthenium and at least one dielectric material (Page 1 Paragraph [003]), providing an aqueous composition comprising about 0.2 to about 6% by weight (Page 4 Paragraph [0034]) silica abrasives having an average particle size of about (50 nm or less). SINHA discloses a range of particle sizes that overlaps with applicant's range and in the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art" a prima facie case of obviousness exists. In re Wertheim, 541 F.2d 257, 191USPQ 90 (CCPA 1976); In re Woodruff, 919 F.2d 1575, 16 USPQ2d 1934 (Fed.Cir. 1990). One of ordinary skill in the art at the time of the invention would have had a reasonable expectation of predictably achieving the desired aqueous composition using the particle size of SINHA.

30. WANG discloses a method of chemical mechanical polishing comprising a substrate with a tantalum removal ratio of the tantalum containing component in relation to the metal layer can be greater than 1 and the removal rate ratio can be less than 1 (Col. 4 lines 60-67). It further discloses that the metal can be ruthenium (Col. 4 lines 32-36). Although WANG does not explicitly disclose applicant's polishing rate, the removal rate ratio of WANG overlaps that of applicant. "In the case where the claimed ranges

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‘overlap or lie inside ranges disclosed by the prior art’ a prima facie case of obviousness exists. In re Wertheim, 541 F.2d 257, 191 USPQ 90 (CCPA 1976); In re Woodruff, 919 F.2d 1575, 16 USPQ2d 1934 (Fed.Cir. 1990).” MPEP 2144.05(I)

31. Although WANG does not explicitly disclose applicant’s removal rate, the removal rate ratio of WANG demonstrates that such rate can be attained by using an appropriate polishing composition and process. Generally, differences in concentration or temperature will not support the patentability of subject matter encompassed by the prior art unless there is evidence indicating such concentration or temperature is critical. “[W]here the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation.” In re Aller, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955)

32. A particular parameter must first be recognized as a result-effective variable, i.e., a variable which achieves a recognized result, before the determination of the optimum or workable ranges of said variable might be characterized as routine experimentation. In re Antonie, 559 F.2d 618, 195 USPQ 6 (CCPA 1977). One of ordinary skill in the art at the time of the invention would have had a reasonable expectation of predictably achieving the desired etching selectivity using the teachings of DIRKSEN in light of the teachings of WANG, MOGGENBORG and SINHA.

33. **With respect to claim 6**, DIRKSEN the use of chloride ions (Page 2 Paragraph [0020]).

34. However DIRKSEN does not disclose the concentration of the chloride ions.

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35. MOGGENBORG discloses chloride ions (Page 2 Paragraph [0013]) in a concentration not to exceed about 0.02M (page 2 Paragraph [0015]).

36. The secondary reference teaches amounts for the chloride ions and it is the examiner's position that when the said amounts are calculated in terms of weight percentage said amounts will encompass the claimed amounts. If applicant wishes to argue the claimed amounts, burden is upon applicant to show the contrary to the above statement (i.e. show that the reference range is not within range of the claimed amount).

37. **With respect to claim 10**, DIRKSEN discloses the use of an amine (Page 2 Paragraph [0020]) in which the composition will have a pH of 7 or less (Page 1 Paragraph [0017]).

38. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over DIRKSEN et al (U.S. Patent Publication No. 2002/0076932) in view of SINHA (U.S. Patent Publication 2003/0119319) and of BRUSI et al (U.S. Patent No. 6,527,622).

39. **With regards to claim 4**, DIRKSEN discloses a method of polishing a substrate surface comprising providing a substrate surface having at least one feature thereon comprising a noble metal (Page 1 paragraph [0008]), providing an aqueous periodic solution (Page 2 Paragraph [0020]), adjusting the pH of the aqueous periodic acid to a pH between 3 and about 7 with a quaternary amine (Page 2 Paragraphs [0017], [0018], *discloses adjusting the to about 7 or less*, Paragraph [0020], *discloses including a quaternary amine*), silica abrasives (Page 1 Paragraph [0009]) and contacting the substrate with the polishing slurry (Page 1 Paragraph [007]).

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40. DIRKSEN is silent as to the concentration and size of the silica abrasive and the concentration of periodic acid. Therefore, one of ordinary skill in the art would have been motivated to look to the related art to find suitable concentrations of abrasives and periodic acid for etching a substrate surface having at least one feature thereon comprising ruthenium and at least one dielectric material.

41. BRUSI discloses a method of polishing a substrate surface comprising a substrate surface having at least one feature thereon comprising ruthenium (Col. 1 lines 52-57, Col. 2 lines 66-67) from about 0.0005 to about 1 moles/kilogram of periodic acid (Col. 6 lines 31-40; Col. 6 line 12) and from about 0.2% to about 6% by weight of silica abrasive (Col. 13 lines 31, 46-48) wherein the aqueous composition is disposed between a polishing pad and the substrate surface (Col. 3 lines 14-18). While BRUSI does not disclose applicant's exact concentrations, generally, differences in concentration or temperature will not support the patentability of subject matter encompassed by the prior art unless there is evidence indicating such concentration or temperature is critical. "[W]here the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation." *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955).

42. SINHA discloses a method of polishing a substrate surface comprising providing a substrate surface having at least one feature thereon comprising ruthenium and at least one dielectric material (Page 1 Paragraph [003]), providing an aqueous composition comprising about 0.2 to about 6% by weight (Page 4 Paragraph [0034]) silica abrasives having an average particle size of about (50 nm or less). SINHA

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discloses a range of particle sizes that overlaps with applicant's range and in the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art" a prima facie case of obviousness exists. In re Wertheim, 541 F.2d 257, 191USPQ 90 (CCPA 1976); In re Woodruff, 919 F.2d 1575, 16 USPQ2d 1934 (Fed.Cir. 1990).

43. Therefore one of ordinary skill in the art at the time of the invention would have had a reasonable expectation of predictably achieving the desired aqueous composition using the particle size of SINHA and concentrations of BRUSI.

44. Claims 8 and 11-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over BRUSI et al (U.S. Patent No. 6,527,622) in view of SINHA et al (U.S. Patent Publication No 2003/0119319), as applied to claims 1, 5, 7, 14 and 18-20, in further view of JACQUINOT et al (U.S. Patent No. 6,043,159)

45. **With regards to claim 8**, the modified teachings of BRUSI discloses all the limitations of claim 1 as previously discussed including wherein the particle size is about 4 nanometers to about 24 nanometers (SINHA, Page 4 Paragraph [0036]).

46. The modified teachings of BRUSI are silent as to the shape of the silica abrasives. Therefore one of ordinary skill in the art would have been motivated to look to the related art to look for suitable particle shapes for etching.

47. JACQUINOT discloses a method of polishing a semiconductor substrate using silica abrasives that are substantial spherical (Col. 1 lines 46-48, *discloses using fumed silica*, Col. 1 lines 53-56, *discloses where the primary particles are of spherical silica*). One of ordinary skill in the art at the time of the invention would have had a reasonable

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expectation of predictably achieving the desired etching conditions using the silica particles of JACQUINOT.

48. **With regards to claim 11**, the modified teachings of BRUSI disclose all the limitations of claim 1 as previously discussed.

49. The modified teachings of BRUSI are silent as to the structure of the silica. Therefore one of ordinary skill in the art would have been motivated to look tot he related art to look for suitable particle for etching.

50. JACQUINOT discloses a method of chemical mechanical polishing a substrate where an aqueous solution of colloidal particles of pyrogenic silica, fumed silica (silica with a 100% chain like structure) with a length to width ratio of at least 4 (Col. 1 lines 53-56, assume structure length of 500nm, width of 50nm, disclosed ratio of 10). One of ordinary skill in the art at the time of the invention would have had a reasonable expectation of predictably achieving the desired etching conditions using the silica particles of JACQUINOT.

51. **With respect to claim 12**, the modified teachings of BRUSI disclose all the limitations of claim 1 as previously discussed.

52. However the modified teachings of BRUIS do not explicitly disclose where in at least 50% of the weight of the silica is in aggregates with an aggregate diameter of about 0.03 to 0.05 microns before polishing. Therefore one of ordinary skill in the art would have been motivated to look tot he related art to look for suitable particle for etching

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53. JACQUINOT discloses a method of chemical mechanical polishing a substrate where an aqueous solution of colloidal particles of pyrogenic silica as an aggregate, fumed silica (silica with a 100% chain like structure as an aggregate) with an aggregate particle diameter of 5-50 nm (0.005 to 0.05 microns) (Col. 1 lines 53-56). One of ordinary skill in the art at the time of the invention would have had a reasonable expectation of predictably achieving the desired etching conditions using the silica particles of JACQUINOT.

54. **With respect to claim 13**, the modified teachings of BRUSI disclose all the limitations of claim 1 as previously discussed.

55. However the modified teachings of BRUIS does not explicitly disclose wherein at least 70% of the weight of the silica is in a chain like structure with a length to width ratio of at least 4 and an aggregate diameter of about .03 to 0.05 microns before polishing.

56. JACQUINOT discloses a method of chemical mechanical polishing a substrate where an aqueous solution of colloidal particles of pyrogenic silica, fumed silica (silica with a 100% chain like structure) in aggregate form (100% of silica in aggregate form) with a length to width ratio of at least 4 (Col. 1 lines 53-56, assume structure length of 500nm, width of 50nm, disclosed ratio of 10) and aggregate particle diameter of 5-50 nm (0.005 to 0.05 microns) 4 (Col. 1 lines 53-56). One of ordinary skill in the art at the time of the invention would have had a reasonable expectation of predictably achieving the desired etching conditions using the silica particles of JACQUINOT.

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57. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over DIRKSEN et al (U.S. Patent Publication No. 2002/0076932) in view of SINHA (U.S. Patent Publication 2003/0119319), as applied to claims 2 and 16, in further view of BRUSI et al (U.S. Patent No. 6,527,622).

58. **With regards to claim 9**, the modified teachings of DIRKSEN disclose all the limitations of claim 2 as previously discussed.

59. The modified teachings of DIRKSEN are silent as to the concentration of silica abrasive and concentration of periodic acid. Therefore, one of ordinary skill in the art would have been motivated to look to the related art to find suitable concentrations of abrasives and periodic acid for etching a substrate surface having at least one feature thereon comprising ruthenium and at least one dielectric material.

60. BRUSI discloses a method of polishing a substrate surface comprising a substrate surface having at least one feature thereon comprising ruthenium (Col. 1 lines 52-57, Col. 2 lines 66-67) from about 0.0005 to about 1 moles/kilogram of periodic acid (Col. 6 lines 31-40; Col. 6 line 12) and from about 0.2% to about 6% by weight of silica abrasive (Col. 13 lines 31, 46-48) wherein the aqueous composition is disposed between a polishing pad and the substrate surface (Col. 3 lines 14-18). While BRUSI does not disclose applicant's exact concentrations, generally, differences in concentration or temperature will not support the patentability of subject matter encompassed by the prior art unless there is evidence indicating such concentration or temperature is critical. "[W]here the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine

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experimentation.” In re Aller, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955).

One of ordinary skill in the art at the time of the invention would have had a reasonable expectation of predictably achieving the desired method of etching using the concentrations of BRUSI.

61. Claim 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over DIRKSEN et al (U.S. Patent Publication No. 2002/0076932) as modified by of SINHA et al. (U.S. Patent Publication No. 2003/0119319), as applied to claims 2 and 16 above, in further view of WANG et al (U.S. Patent No. 6,316,365).

62. **With regards to claim 15**, the modified teachings of DIRKSEN disclose all the limitations of claim 2 as previously discussed.

63. However the modified teachings of DIRKSEN is silent as to where in the substrate comprises at least one of tantalum oxide or titanium oxide, where in the polishing rate of the tantalum oxide and/or titanium oxide is between 0.9 and 1.3 times the polishing rate of ruthenium (polishing rate ratio of 0.77-1.11, calculated based on polishing rate of 300 Å/min, disclosed on page 25 of Specification).

64. WANG discloses a method of chemical mechanical polishing comprising a substrate of tantalum and a conductive metal (Col. 3 lines 31-34, Col. 4 lines 32-37, *discloses conductive material may be ruthenium*) with a tantalum removal ratio of the tantalum containing component in relation to the metal layer can be greater than 1 and the removal rate ratio can be less than 1 (Col. 4 lines 60-67). Although WANG does not explicitly disclose applicant's removal rate, the removal rate ratio of WANG

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demonstrates that such rate can be attained by using an appropriate polishing composition and process. Generally, differences in concentration or temperature will not support the patentability of subject matter encompassed by the prior art unless there is evidence indicating such concentration or temperature is critical. “[W]here the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation.” *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955)

65. A particular parameter must first be recognized as a result-effective variable, i.e., a variable which achieves a recognized result, before the determination of the optimum or workable ranges of said variable might be characterized as routine experimentation. *In re Antonie*, 559 F.2d 618, 195 USPQ 6 (CCPA 1977). One of ordinary skill in the art at the time of the invention would have had a reasonable expectation of predictably achieving the desired etching selectivity using the teachings of WANG in light of the modified teachings of DIRKSEN.

66. Claim 17 is rejected under 35 U.S.C. 103(a) as being unpatentable over BRUSI et al (U.S. Patent No. 6,527,622) in view of SINHA et al (U.S. Patent Publication No 2003/0119319), as applied to claims 1, 5, 7, 14 and 18-20, in further view of SHEMA et al (U.S. Patent No. 6,258,140).

67. **With regards to claim 17**, the modified teachings of BRUSI disclose all the limitations of claim 1 as previously discussed in addition disclose wherein the aqueous composition consist essentially of water (Col. 3 lines 53-54), periodic acid (Col. 6 line

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12), and the silica abrasive (Col. 3 line 31), and wherein the solution has a pH of about 2 to about 5 (Col. 6 lines 41-42).

68. However the modified teachings of BRUSI does not explicitly disclose including one or more quaternary amines.

69. SHEMA discloses a method of polishing a substrate including a polishing composition including a quaternary amine (Col. 6 lines 30-31, *discloses including a quaternary ammonium salt*).

70. It would have been *prima facie* obvious at the time of the invention to modify the modified teachings of BRUSI to include the quaternary amine of SHEMA because the reference of SHEMA teaches that the use of quaternary amine is added to reduce the chattering or carrier noise generated between the substrate to be polished and the carrier for holding it during polishing and may in addition reduce the polishing resistance (Col. 6 lines 22-27).

Response to Arguments

71. Applicant's arguments with respect to claim 1-20 have been considered but are moot in view of the new ground(s) of rejection.

72. Applicant's arguments, see Pages 5-8, filed March 16, 2010, with respect to the rejection(s) of claim(s) 1, 7-8, and 18-20 have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a

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new ground(s) of rejection is made in view of BRUSI et al (U.S. Patent No. 6,527,622) in view of SINHA et al (U.S. Patent Publication No 2003/0119319).

73. Applicant's arguments filed March 16, 2010 have been fully considered but they are not persuasive with regards claims 2 and 16.

74. With regards to claims 2 and 16 on Pages 9-11 of Applicant's response, applicant generally argues that there is no motivation for combining the references of DIRKSEN and SINHA. In particular Applicant argues that that the primary reference DIKSEN does not mention selectivity at all and SINHA does not disclose achieving the selectivity with the composition sited in claim 2 (Applicant's Response Page 10). Examiner respectfully disagrees with the applicant's assertion. In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

75. Applicant's arguments see Pages 11-16 filed March 16, 2010, with respect to the rejection(s) of claim(s) 3, 6 and 10 have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made as discussed above.

76. Applicant's arguments see Pages 16-18 filed March 16, 2010, with respect to the rejection(s) of claim(s) 4 and 7 have been fully considered and are persuasive.

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Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made as discussed above.

77. Applicant's arguments see Pages 18-19 filed March 16, 2010, with respect to the rejection(s) of claim(s) 5 have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made as discussed above.

78. Applicant's arguments see Pages 19-20 filed March 16, 2010, with respect to the rejection(s) of claim(s) 9 have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made as discussed above.

79. Applicant's arguments see Pages 20-24 filed March 16, 2010, with respect to the rejection(s) of claim(s) 11-13 have been fully considered and are persuasive.

Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made as discussed above.

80. Applicant's arguments see Pages 24-25 filed March 16, 2010, with respect to the rejection(s) of claim(s) 14 have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made as discussed above

81. Applicant's arguments see Pages 25-26 filed March 16, 2010, with respect to the rejection(s) of claim(s) 15 have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made as discussed above

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to STEPHANIE DUCLAIR whose telephone number is (571)270-5502. The examiner can normally be reached on Monday - Friday, 8:00AM - 4:30PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on 571-272-1465. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/S. D./
Examiner, Art Unit 1713

/Binh X Tran/
Primary Examiner, Art Unit 1713